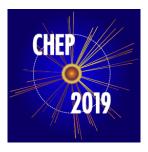
24th International Conference on Computing in High Energy & Nuclear Physics



Contribution ID: 580 Type: Oral

Fast simulation methods in ATLAS: from classical to generative models

Monday 4 November 2019 14:15 (15 minutes)

The ATLAS physics program relies on very large samples of GEANT4 simulated events, which provide a highly detailed and accurate simulation of the ATLAS detector. However, this accuracy comes with a high price in CPU, and the sensitivity of many physics analyses is already limited by the available Monte Carlo statistics and will be even more so in the future. Therefore, sophisticated fast simulation tools are developed. In Run-3 we aim to replace the calorimeter shower simulation for most samples with a new parametrized description of longitudinal and lateral energy deposits, including machine learning approaches, to achieve a fast and accurate description. Looking further ahead, prototypes are being developed using cutting edge machine learning approaches to learn the appropriate calorimeter response, which are expected to improve modeling of correlations within showers. Two different approaches, using Variational Auto-Encoders (VAEs) or Generative Adversarial Networks (GANs), are trained to model the shower simulation. Additional fast simulation tools will replace the inner detector simulation, as well as digitization and reconstruction algorithms, achieving up to two orders of magnitude improvement in speed. In this talk, we will describe the new tools for fast production of simulated events and an exploratory analysis of the deep learning methods.

Consider for promotion

Authors: GHOSH, Aishik (Centre National de la Recherche Scientifique (FR)); SALAMANI, Dalila (Universite de Geneve (CH)); ROUSSEAU, David (LAL-Orsay, FR); LOUPPE, Gilles (New York University (US)); STEWART, Graeme A (CERN); AHMED, Hasib (The University of Edinburgh (GB)); GRAY, Heather (LBNL); SCHAARSCHMIDT, Jana (University of Washington (US)); CHAPMAN, John Derek (University of Cambridge (GB)); RAINE, Johnny (Universite de Geneve (CH)); CRANMER, Kyle Stuart (New York University (US)); GADATSCH, Stefan (Universite de Geneve (CH)); GOLLING, Tobias (Universite de Geneve (CH)); LARI, Tommaso (University and INFN, Milano); PASCUZZI, Vincent (University of Toronto (CA))

Presenter: RAINE, Johnny (Universite de Geneve (CH)) **Session Classification:** Track 2 –Offline Computing

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